

**COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER PLANNING DIVISION
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Subject: Guidance Memo No. 09-2005
Monitoring of Lakes and Reservoirs

To: Regional Directors

From: Jutta Schneider, Water Planning Division Director

Date: October 26, 2020

Copies: Regional Water Quality Planning Managers and staff, Water Planning Division Managers, WMA Staff

Summary:

This guidance supersedes all agency Monitoring of Lakes and Reservoirs guidance prior to 2020 and provides direction to agency staff on how to implement lake/reservoir water quality monitoring. Significant updates to this guidance since 2002 include implementing the new surface water quality standard regulation (9 VAC 25-260-187), effective as of August 14, 2007, which added nutrient criteria for significant man-made lakes and reservoirs and the two natural lakes in Virginia. Triennial Review updates to 9 VAC 25-260-187 include the definition of lacustrine zone, which allows for dissolved oxygen sampling throughout the lake to determine thermal stratification and adds several additional lakes (8) to the significant lakes list. Updates to 9VAC25-260-50 include applying dissolved oxygen and pH criteria only to the epilimnion of thermally-stratified lakes listed in 9 VAC 25-260-187. In 2020, all references to lake/reservoir assessment methodology were moved to DEQ's Water Quality Assessment Guidance Manual.

Electronic Copy:

Once effective, an electronic copy of this guidance will be available on:

- The Virginia Regulatory Town Hall under the Department of Environmental Quality (<http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440>); or,
- The Department's website at:
<https://www.deq.virginia.gov/Programs/Water/Laws,Regulations,Guidance/Guidance/MonitoringAssessmentGuidance.aspx>

Contact Information:

Please contact Sandra Mueller, Manager of the Office of Water Monitoring and Assessment at sandra.mueller@deq.virginia.gov, or via phone at (804) 698-4324 with any questions regarding the application of this guidance.

Certification:

As required by Subsection B of § 2.2-4002.1 of the APA, the agency certifies that this guidance document conforms to the definition of a guidance document in § 2.2-4101 of the Code of Virginia.

Disclaimer:

This document has been developed based on Virginia's Water Quality Standards Regulation (9 VAC 25-260), with amendments approved by the State Water Control Board resulting from iterative Triennial Reviews or periodic rulemakings. It is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate nor prohibit any particular method for the analysis of data, establishment of a wasteload allocation, or establishment of a permit limit. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

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MONITORING OF LAKES AND RESERVOIRS

I. Introduction

The purpose of this guidance is to ensure that consistent and accurate processes are employed for the monitoring of lakes and reservoirs. In particular, this guidance focuses on proper data collection for implementation of the amended nutrient criteria for these waterbodies.

II. Background

The Water Quality Standards regulation was amended in August 2007 and June 2017 to add numerical and narrative criteria to protect the designated aquatic life (fishery) use of man-made lakes/reservoirs, as well as the two natural lakes in the Commonwealth, Mountain Lake and Lake Drummond, from the impacts of nutrients. The rulemakings:

- clarified that the dissolved oxygen (DO) criterion applies ONLY to the epilimnion ONLY during times of thermal stratification; at all other times DO criteria applies throughout the water column within all zones of the water body (9VAC25-260-50),
- clarified that the pH criterion applies ONLY to the epilimnion ONLY during times of thermal stratification; at all other times DO criteria applies throughout the water column within all zones of the waterbody (9VAC25-260-50),
- added a process for confirmation of use impairments with the Department of Wildlife Resources (DWR, previously DGIF) when the criteria in Section 187 are exceeded (9 VAC 25-260-187. C.),
- allowed for site specific regulatory modifications to the criteria if the nutrient criteria specified for a lake or reservoir do not provide for the attainment and maintenance of the water quality standards of downstream waters (9 VAC 25-260-187. D.),
- and the most recent Triennial Review updates also included the addition of two (2) lakes to the significant lakes list.

This guidance is intended to:

1. provide additional technical information related to the development of the adopted nutrient criteria,
2. make recommendations on how to determine where to monitor within a lake or reservoir to gather the data needed for assessments, and
3. provide information on monitoring of all lakes and reservoirs in Virginia.

When and where (temporally and spatially) within a lake or reservoir nutrient, dissolved oxygen and pH criteria should be applied for assessment purposes has been moved to DEQ's Water Quality Assessment Manual beginning with the 2022 Water Quality Assessment Guidance Manual.

III. Authority

§ 62.1-44.15(3a) of the Code of Virginia, as amended, mandates and authorizes the State Water Control Board to establish water quality standards and policies for any State waters consistent with the purpose and general policy of the State Water Control Law, and to modify, amend or cancel any such standards or policies established. Section 303(c) of the federal Clean Water Act mandates the State Water Control Board to review and, as appropriate, modify and adopt water quality standards. The corresponding federal water quality standards regulation at 40 CFR 131.6 describes the minimum requirements for water quality standards. The minimum requirements are use designations, water quality criteria to protect the designated

uses and an anti-degradation policy. All of the citations mentioned describe mandates for water quality standards.

IV. Definitions

“Algaecides” means chemical substances, most commonly copper-based, used as a treatment method to control algal growth.

“Assessment period” refers to a “period of time (currently six years) for which data are used in a Water Quality Assessment.”

“Epilimnion” means the upper layer of nearly uniform temperature in a thermally stratified man-made lake or reservoir listed in 9 VAC 25-260-187.B.

“Lacustrine” means the zone within a lake or reservoir that corresponds to nonflowing lake-like conditions with areas that are deeper than 3m (10 feet). The other two zones within a reservoir are riverine (flowing, river-like conditions) and transitional (transition from river to lake conditions).

“Lake/Reservoir” means a constructed impoundment and refers to Virginia man-made lakes and reservoirs

“Monitoring period” refers to “April 1 through October 31.”

“Monitoring year” refers to “seven months from April 1 through October 31.”

“Natural Lake” means a lake that is natural in origin. There are two natural lakes in Virginia: Mountain Lake in Giles County and Lake Drummond located within the boundaries of Chesapeake and Suffolk in the Great Dismal Swamp.

“Publicly accessible” means any legal passage to any public waters of the state by way of contiguous designated public land.

“Strahler Order” is a simple method of classifying stream segments based on the number of tributaries upstream. A stream with no tributaries (headwater stream) is considered a first order stream. A segment downstream of the confluence of two first order streams is a second order stream. Thus, a n^{th} order stream is always located downstream of the confluence of two $(n-1)^{\text{th}}$ order streams.

In addition, the following definitions of fishery type were used in making nutrient criteria assignments based on fishery type and nutrient ecoregion as described in section V. of this guidance document:

“Coldwater fishery” means a fishery in a man-made lake or reservoir for the year-round support of brook, brown, and rainbow trout.

“Coolwater fishery” means a fishery in a man-made lake or reservoir for the year-round support of game fish species such as striped bass, hybrid striped bass, or walleye.

“Fertilized fishery” means man-made lakes or reservoirs managed by the Virginia Department of Game and Inland Fisheries (DGIF) with fertilizers applied as a management input for centrarchid species (for example, sunfish, crappie, and black bass) or catfish species. These lakes are generally quite small, and fish production is the primary use.

“Warmwater fishery” means a fishery in a man-made lake or reservoir for the year-round support of warmwater fish such as largemouth and smallmouth bass, sunfish and catfish, and not explicitly classified as a coldwater, coolwater or fertilized fishery.

V. Guidance

A. Sources for Lakes and Reservoirs Listed in the Table in 9 VAC 25-260-187

Current List: The list of lakes and reservoirs in Section 187 was developed from three Virginia DEQ sources: 1) the significant lake list for the agency (2002 targeted lake monitoring guidance), 2) the revised significant lakes list for 2006, and 3) 59 lakes and reservoirs monitored by VA DEQ between 1990 and 2003, these were included in the Academic Advisory Committee (AAC) analysis for nutrient criteria development. These are the lakes and reservoirs that DEQ has monitored previously, currently is monitoring or will be monitoring in the upcoming assessment cycle.

Future Listings: DEQ anticipates that additional lakes and reservoirs will be added to the regulation during triennial review and will propose adding to the list of Section 187.B additional lakes and reservoirs which the agency has recently monitored or included in the monitoring plan for future monitoring. Prior to the initiation of a rulemaking to add or modify a current listing in Section 187.B, staff from the Fish Division of the Virginia DGIF must be contacted to confirm the appropriate fishery type for that particular lake/reservoir.

Removal from List: In rare instances, DEQ may receive a request to remove a lake/reservoir from Section 187.B. Removal of a lake/reservoir would be subject to the DEQ Public Participation Guidelines, state Administration Process Act requirements and EPA approval.

B. Basis for Nutrient Criteria Assignment by Fishery Type and Nutrient Ecoregion in Section 187.B

The table in Section 187.B of the amendments provides the numerical chlorophyll *a* and total phosphorus criterion applicable to that particular lake/reservoir. It is simplified in this guidance for reference (Table 1), but the actual Section 187.B table should be utilized for agency monitoring purposes to ensure that updated information is being used.

Virginia Nutrient Ecoregions: The following three aggregate nutrient ecoregions developed (see below Figure 1) by the Environmental Protection Agency (EPA) were used in development of the nutrient criteria.

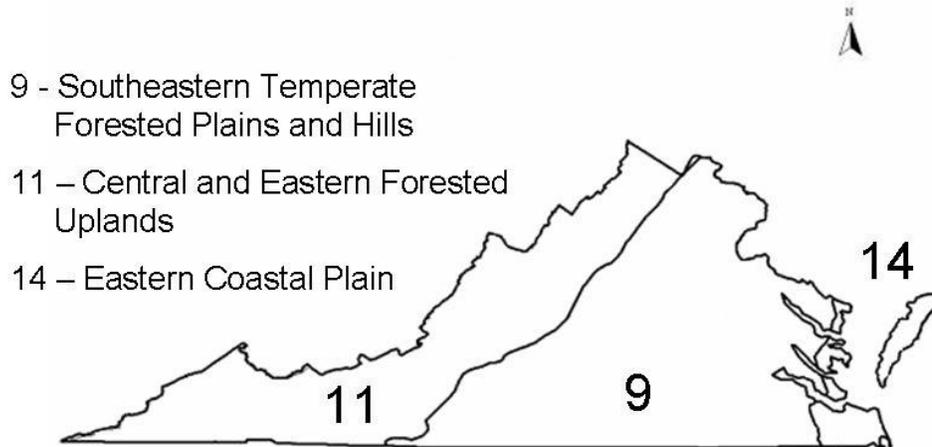


Figure 1 Virginia Nutrient Ecoregions

Listing of Fishery Type and Ecoregion for Each Man-made Lake/Reservoir: Appendix I summarizes a known name applicable to a particular body of water, city or county location of the water body, fishery type, ecoregion and name of the USGS topographic map.

Fishery Type Assignments: Pages 10 - 11 and 16 - 33 of the AAC January 2005 Report <http://www.deq.virginia.gov/export/sites/default/wqs/pdf/AAC05report.pdf> discuss the use of fishery data by ecoregion and fishery type for setting criteria for chlorophyll *a* and total phosphorus.

Applicable Criteria by Fishery Type and Ecoregion: Table 1 (below) provides the candidate criteria recommended by the AAC July 2005 Addendum One to the January Report http://www.deq.virginia.gov/export/sites/default/wqs/documents/Nutrient_Criteria/AAC_Report_Addendum_5_26_05.doc to accommodate fishery recreation and protect aquatic life.

Table 1. Applicable Criteria by Fishery Type and Ecoregion in Virginia

Fishery Type	Warm-water	Cool-water	Cold-water (trout)	Managed / Fertilized	Warm-water	Cool-water	Cold-water (trout)	Managed / Fertilized
Eco-region	----- chl-a (µg/L) ^a -----				----- TP (µg/L) ^b -----			
11	35	25	10		40	20	10	
9	35	25		60	40	30		40
14	60	25			40	20		

^a Chl-a are 90th percentile values representative of the April – October period.

^b TP is the median values representative of the April – October period.

C. Monitoring

C.1. Determination of Section 187 Lake/Reservoir Boundaries

Description of Lake/Reservoir boundaries: The nutrient criteria only apply in the lacustrine zone of the lakes/reservoirs listed in Section 187 i.e. “Water Quality Standards” 9-VAC 25-260-187. The other two zones within a lake/reservoir are riverine (flowing, river-like conditions) and transitional (transition from river to lake conditions). Lakes and reservoirs usually have these three zones along a longitudinal gradient (See Figure 2.). For assessment purposes, DEQ defines the lacustrine zone as the area of the lake where the depth is greater than 3 meters (10ft).

The littoral zone of a lake/reservoir is often described as the near shore area where sunlight penetrates all the way to the sediment and allows aquatic plants to grow. It is sometimes defined as a shallow area approximately three meters or less deep extending from the shoreline lake ward, but it depends on water clarity, light transmission and where rooted plants can grow. Therefore, no sampling should be done where there are rooted aquatic plants during the growing season. Chlorophyll *a* or total phosphorus data collected at less than 3 meters (10 ft.), e.g. within the littoral zone will not be used in the assessment for impairment due to nutrients.

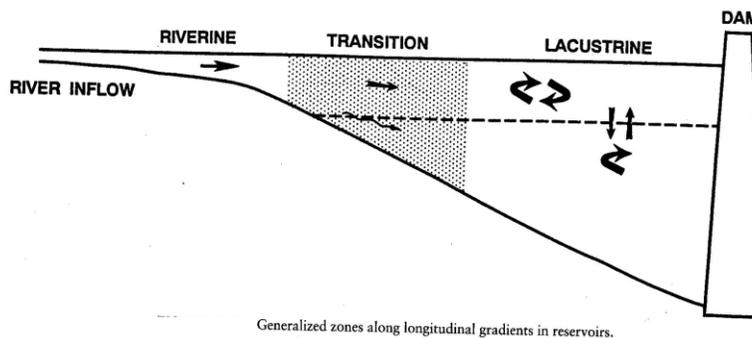


Figure 2 Generalized Zones along Longitudinal Gradients in Reservoirs (Wetzel, 2001)

The riverine zone is located at the most upstream sections (near the inlets) of lakes and reservoirs and displays “river-like” flow characteristics. At the riverine end of the lake/reservoir, thermal stratification tends to be

unstable and turbidity and sedimentation rates are higher than downstream in the lacustrine zone. The transition zone is deeper than the riverine zone and flows are generally slower. The lacustrine zone behaves most like a lake, where thermal stratification would most likely occur (from late spring to early fall.) There may be arms of the lake/reservoir that are considered lacustrine, exhibiting non-flowing, lake-like conditions. In this scenario, the lake monitoring team should use their best professional judgment in the assessment of arms, coves, etc.

In small, shallow (less than 3m in depth (10ft)) lakes and reservoirs where the classic lacustrine, transition and riverine zones are not pronounced, the lacustrine zone and nutrient criteria in Section 187 of the water quality standards regulation apply in a representative area of the water body.

Figure 3, taken from Kimmel and Groeger (1984), illustrates the transition from a riverine to lacustrine environment in lakes and reservoirs along a longitudinal gradient and describes the differences in the characteristics of these three zones.

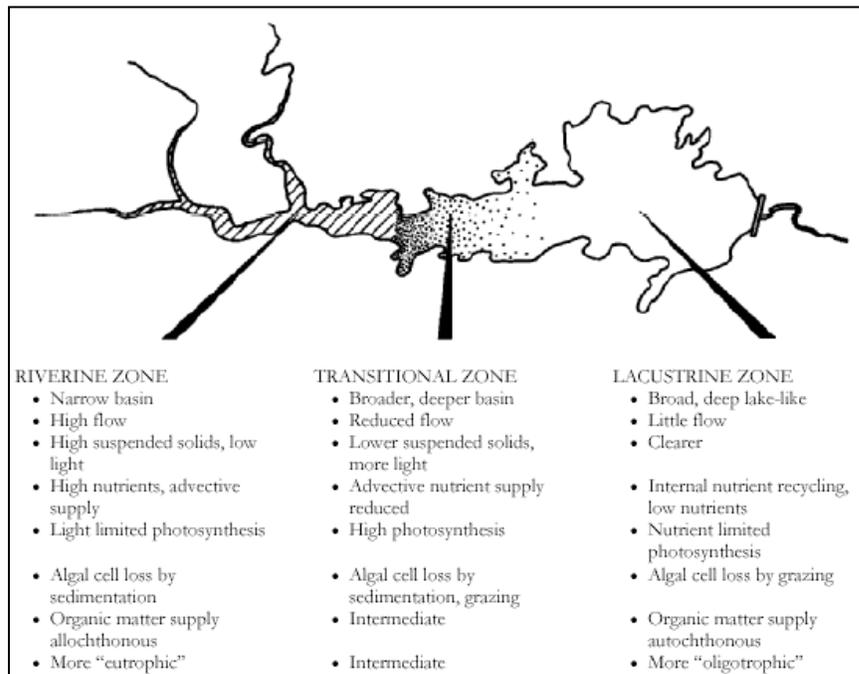


Figure 3 General Characteristics of the Riverine, Transitional and Lacustrine Zones in Reservoirs

C.2. Guidelines for identification of lake/reservoir zones for assessment

For the assessment of lakes and reservoirs sampled during the previous six years of targeted lake/reservoir monitoring, regional monitoring staff will:

- Identify lakes/reservoirs where algaecides are used during DEQ's monitoring period so assessment staff will know to use the total phosphorus criterion as well as chlorophyll *a*,
- All sample collections and field measurements should be made in the deepest mid-channel of any zone, cove or inlet within a lake/reservoir's boundary
- Identify station location (with all associated ID's i.e. CEDS) where:
 - chlorophyll *a* and total phosphorus (if documented use of algaecide) samples were collected in the lacustrine zone (greater than 3 meters (10ft)).
 - dissolved oxygen/pH/temperature profile measurements were recorded anywhere in the lake/reservoir.

Description of lacustrine boundaries:

1. The lacustrine zone is the area that corresponds to non-flowing, lake-like conditions, which is usually the deepest part of the lake/reservoir, typically 3m (10ft) or deeper, where stratification normally occurs from spring through fall. (If a lake has a round shape, the lacustrine zone may be in the center of the lake. If the lake is shallow (less than 3m), without defined depths, sample in a representative portion of the lake/reservoir)
2. The upper boundary of the lacustrine zone is where a slope and broadening of the basin begins.

The other two zones of a lake include; *Transition*: The transition zone falls between the upper end of the lacustrine zone and the lower end of the riverine. *Riverine*: Depths less than one-third of the depth of the upper boundary of the lacustrine zone can be assumed to be located within the riverine zone at the upper end of the impoundment.

C. 3. Sampling littoral zone and coves and inlets.

Sampling near-shore or littoral zones (depths less than 3 meters (10ft)) should be avoided when sampling for nutrients in Section 187 waters; data collected from the littoral zone of a lake/reservoir by agency staff or outside groups will not be used for assessment of nutrients and possibly dissolved oxygen (DO) (see Section D.1). All other parameters apply throughout a lake/reservoir.

The perimeters of irregular lakes or reservoirs are often characterized by various types of inlets. For the purpose of this guidance, two types of inlets are differentiated:

- **Riverine** tributary inlets are defined as inlets with well-defined channels produced by the inflow of a tributary stream of 2nd or higher Strahler order. Waters in these inlets are likely to be more characteristic of the inflowing stream than of the receiving lake, and should not be sampled during monitoring events.
- **Coves (including arms and fingers)** are defined as inlets that are longer than they are broad. They should only be sampled from the center of their channel and only when their depth is greater than 3 meters (10 ft).

C. 4. Monitoring period, frequency of nutrient sampling, and location of monitoring stations

A monitoring year is considered to be April 1 through October 31 with a monthly sampling frequency during one calendar year. Man-made lakes/reservoirs listed in Section 187 must be sampled with one or more nutrient observations per month for at least six of the seven sampling months within the same calendar year to be considered a valid monitoring year. Based on regional prioritization and available resources, each Section 187 listed lake/reservoir should have two monitoring years within the six year Assessment Cycle data window. The regional office should schedule a second year of monitoring for a lake/reservoir, within the same assessment window in order to verify the impairment. Assessment is based on the two most recent monitoring years that data are available within the assessment window. However, there are two situations where additional sampling should be done in a subsequent year:

- If sampled for fewer than six of the seven sampling months within a calendar year, the lake or reservoir is placed in Category 3 (insufficient data) for assessment purposes and sampling is conducted in the next calendar year.
- A third year of monitoring may be required if the previous two years result in differing assessment statuses. This monitoring should be done as soon as resources allow.

Sampling location in lacustrine zone: The number of monitoring stations within the lacustrine zone depends on the size and shape of the lake or reservoir. The 2001 edition of the North American Lake Association's "Managing Lakes and Reservoirs" is a good reference to use to determine location of monitoring stations. If it is a shallow (under 3meters (10ft.)) lake/reservoir, there might be only one station sampled per monthly visit. The monitoring station should be placed in the deepest part of the lake/reservoir either near the dam in reservoirs or in the deep center portion of natural lakes, with collections monthly over the seven month period of April through October.

Only data from the lacustrine portion of the lake/reservoir, down to a depth of one meter will be assessed for attainment of the chlorophyll *a* and total phosphorus criteria. That should not preclude regional sampling for nutrients in the riverine and transition zones or coves and arms or the littoral zone as new nutrient criteria are being developed for wadeable waters.

C. 5. Parameter Selection for Analysis

Minimum parameter lists and monitoring frequency are identified by lake/reservoir monitoring assessment goal (Table 2). Regional offices may elect to have the laboratory analyze samples for additional parameters to meet other regional needs. For example, some regional offices with significant VPDES discharges to a lake/reservoir might elect to run biochemical oxygen demand and suspended solids. For 305(b) assessment purposes, the recommended minimum parameter list is dissolved oxygen, pH, Chlorophyll *a*, temperature, bacteria, nutrients, conductivity and salinity (where appropriate). To determine trophic status or potential need for regulatory designation as a nutrient enriched water, the following parameters need to be collected: conductivity, Secchi disk depth, chlorophyll *a*, dissolved oxygen/temperature depth profile, total nitrogen, total phosphorus and orthophosphorus. The recommended parametric coverage for toxicity assessment is: ammonia, pesticide/herbicide scan and metals scan in sediments. Table 3 lists lake/reservoir monitoring parameter group codes for samples submitted to the state laboratory (DCLS) for analysis.

Table 2. Minimum Required Parameter List by Type of Assessment 305(b):

- Dissolved Oxygen - entire profile top to bottom
- pH – entire profile top to bottom
- Temperature – entire profile top to bottom
- E. coli (0.3 meters below surface)
- Conductivity
- Salinity (where appropriate) Trophic State/Nutrient Enrichment
- Secchi Disk Depth
- Chlorophyll *a* (0.3 meters or up to 1 meter)
- Total Phosphorous
- Total Orthophosphorous
- Total Nitrogen
- Nitrite (NO²)
- Nitrate (NO³)
- Ammonia Concentrations in water

Table 3. Lake Monitoring Suggested Parameter Group Codes for Samples Submitted to DCLS for Analysis

- **Field** – DO (% saturation and concentration), pH, Conductivity, Temperature
- **FCHLR**-Chlorophyll *a*
- **ECQT10** – E.Coli
- **FCMFECQENT** – E.Coli, Fecal Coliform, Enterococci (for Lake Trend stations only)
- **TPLL** – Total Phosphorus
- **LAKE-2** – Ammonia, Total Nitrogen, Orthophosphorus, Nitrite plus Nitrate

C. 6. Field Measurements

Field measurements at each sampling station should include a temperature, dissolved oxygen (concentration and % saturation) and pH profile (beginning at 0.3 meter below surface using a combined temperature-pH-dissolved oxygen meter). Field measurements should also include conductivity and Secchi depth. All of these field measurements, including the dissolved oxygen/temperature/pH depth profile data, should be entered into the CEDS Water Quality Monitoring database.

D. Lake Selection

Source List of Lakes: 9VAC25-260-187 (Section 187) now serves as the source list of lakes for prioritization and selection for monitoring by DEQ. The current list can also be found as [Appendix H of DEQ's Water Quality Assessment Guidance Manual](#). Significant lakes are defined as "All publicly accessible lakes that are either public water supplies or 100 acres or more in size." This definition includes the federally owned lakes that meet these criteria, but other federally owned lakes are excluded from the agency's Lake Monitoring Program. Under the current (2018) classification, 123 reservoirs and 1 lake are included in the prioritization list. Seventy-five (75) of these are identified as Public Water Supply (PWS) sources. Only one of Virginia's two natural lakes, Lake Drummond within the Great Dismal Swamp National Wildlife Refuge, is currently included in the prioritization list. The other, Mountain Lake (48 acres), is privately owned and is intensively monitored by the University of Virginia.

Periodic Updates to the List: It is the responsibility of each region to periodically review Section 187 of the Virginia Water Quality Standards (WQS) and coordinate updates to the list with Central Office. Although this list may be updated and change slightly from one two-year assessment cycle to the next, most major reservoirs and lakes meet the criteria for inclusion and are monitored on a permanent basis. The mapping precision provided by Geographic Information Systems (GIS) has also resulted in more accurate area determinations, which may influence the inclusion or not of small reservoirs. An improved WQS layer, better representing all of the significant and assessed lakes in the state, was completed in 2018 using the high resolution National Hydrography Dataset. This layer will be used to more efficiently complete assessments for the Integrated Report, as well as to provide information to the public through internet mapping applications.

Prioritization for Monitoring: All lakes must be publicly accessible to be considered for monitoring resources. After the lakes are prioritized, each region determines how many lakes they have resources to monitor in any given year.

Documentation of Alternative Basis for Selection for Monitoring: Section 187 is a starting point for prioritizing lakes in need of monitoring, but it is not intended to prevent a region from using a different approach if required by a unique circumstance, i.e. citizen concerns over recreation impacts in public lakes.

E. Additional Information

All Virginia DEQ and AAC referenced reports can be found at <http://www.deq.state.va.us/wqs/rule.html#NUT2>

APPENDIX I

Listing of Fishery Type and Ecoregion for Man-made Lakes and Reservoirs in Virginia

Man-made Lake/Reservoir Name	DEQ Region	Location	Fishery Type	Ecoregion	USGS 1:24,000 Topo Map Name
Able Lake	Northern	Stafford County	Warmwater	9	Stafford
Airfield Pond	Tidewater	Sussex County	Warmwater	9	Manry
Amelia Lake	Piedmont	Amelia County	Warmwater	9	Chula
Aquia Reservoir (Smith Lake)	Northern	Stafford County	Warmwater	11	Stafford
Bark Camp Lake (Corder Bottom Lake, Lee/Scott/Wise Lake)	Southwest	Scott County	Warmwater	11	Fort Blackmore
Beaver Creek Reservoir	Valley	Albemarle County	Warmwater	9	Crozet
Beaverdam Creek Reservoir (Beaverdam Reservoir)	Blue Ridge	Bedford County	Warmwater	11	Stewartsville
Beaverdam Reservoir	Northern	Loudoun County	Warmwater	9	Leesburg
Bedford Reservoir (Stony Creek Reservoir)	Blue Ridge	Bedford County	Warmwater	11	Peaks of Otter
Big Cherry Lake	Southwest	Wise County	Warmwater	11	East Stone Gap
Breckenridge Reservoir	Northern	Prince William County	Warmwater	9	Joplin
Briery Creek Lake	Piedmont	Prince Edward County	Warmwater	9	Hampden Sydney
Brunswick Lake (County Pond)	Piedmont	Brunswick County	Warmwater	9	Smokey Ordinary
Burke Lake	Northern	Fairfax County	Fertilized	9	Fairfax
Carvin Cove Reservoir	Blue Ridge	Botetourt County	Warmwater	11	Daleville/Roanoke
Cherrystone Reservoir	Blue Ridge	Pittsylvania County	Warmwater	9	Chatham
Chickahominy Lake	Piedmont	Charles City County	Warmwater	9	Walkers
Chris Green Lake	Valley	Albemarle County	Warmwater	9	Luray
Claytor Lake	Blue Ridge	Pulaski County	Coolwater	11	Dublin/Radford South
Clifton Forge Reservoir (Smith Creek Reservoir)	Blue Ridge	Alleghany County	Warmwater	11	Clifton Forge
Coles Run Reservoir	Valley	Augusta County	Coldwater	11	Big Levels
Curtis Lake	Northern	Stafford County	Fertilized	9	Storck
Diascund Creek Reservoir	Piedmont	New Kent County	Warmwater	9	Walkers
Douthat Lake	Valley	Bath County	Coolwater	11	Healing Springs
Elkhorn Lake	Valley	Augusta County	Coldwater	11	Stokesville
Emporia Lake (Meherrin Reservoir)	Piedmont	Greensville County	Warmwater	9	Emporia

Fairystone Lake	Blue Ridge	Henry County	Warmwater	11	Philpott Lake
Falling Creek Reservoir	Piedmont	Chesterfield County	Warmwater	9	Drewrys Bluff
Fluvanna Ruritan Lake	Valley	Fluvanna County	Fertilized	9	Simon/Boyd Tavern
Fort Pickett Reservoir	Piedmont	Nottoway/Brunswick County	Warmwater	9	Danieltown/Blackstone East
Gatewood Reservoir	Blue Ridge	Pulaski County	Warmwater	11	Longspur/Pulaski
Georges Creek Reservoir (Gretna Lake)	Blue Ridge	Pittsylvania County	Warmwater	9	Gretna
Goose Creek Reservoir	Northern	Loudoun County	Warmwater	9	Leesburg
Graham Creek Reservoir (Elon Waterworks Reservoir)	Blue Ridge	Amherst County	Warmwater	9	Lynchburg
Great Creek Reservoir	Piedmont	Lawrenceville	Warmwater	9	Alberta
Harrison Lake	Piedmont	Charles City County	Warmwater	9	Westover
Harwoods Mill Reservoir	Tidewater	York County	Warmwater	14	Poquoson West
Hidden Valley Lake	Southwest	Washington County	Warmwater	11	Brumley
Hogan Lake	Blue Ridge	Pulaski County	Warmwater	11	Pulaski
Holiday Lake	Piedmont	Appomattox County	Warmwater	9	Holiday Lake
Hungry Mother Lake	Southwest	Smyth County	Warmwater	11	Chatam Hill/Marion
Hunting Run Reservoir	Northern	Spotsylvania County	Warmwater	9	Chancellorsville
J. W. Flannagan Reservoir	Southwest	Dickenson County	Coolwater	11	Clintwood/Haysi
Kerr Reservoir, Virginia portion (Buggs Island Lake)	Blue Ridge	Halifax County,	Coolwater	9	John H. Kerr Dam/Tungsten/Clarksville South/Clarkesville North
Keysville Reservoir	Blue Ridge	Charlotte County	Warmwater	9	Eureka/Keysville
Lake Albemarle	Valley	Albemarle County	Warmwater	9	Crozet
Lake Anna	Northern	Louisa County	Coolwater	9	Lake Anna East/Lake Anna West/Mineral
Lake Arrowhead	Valley	Page County	Warmwater	11	Luray
Lake Burnt Mills	Tidewater	Isle of Wight County	Warmwater	14	Chuckatuck/Windsor
Lake Chesdin	Piedmont	Chesterfield County	Warmwater	9	Sutherland/Beach/Winterpock
Lake Cohoon	Tidewater	Suffolk City	Warmwater	14	Windsor
Lake Conner	Blue Ridge	Halifax County	Warmwater	9	Conner Lake

Lake Frederick	Valley	Frederick County	Warmwater	11	Stephens City
Lake Gaston, (Virginia portion)	Blue Ridge	Brunswick County	Coolwater	9	South Hill SE/Bracey
Lake Gordon	Blue Ridge	Mecklenburg County	Warmwater	9	South Hill
Lake KEOOKEE	Southwest	Lee County	Warmwater	11	Big Stone Gap
Lake Kilby	Tidewater	Suffolk City	Warmwater	14	Suffolk
Lake Lawson	Tidewater	Virginia Beach City	Warmwater	14	Little Creek
Lake Manassas	Northern	Prince William County	Warmwater	9	Thoroughfare Gap
Lake Meade	Tidewater	Suffolk City	Warmwater	14	Chuckatuck/Suffolk
Lake Moomaw	Blue Ridge	Bath County,	Coldwater	11	Falling Spring/Mountain Grove
Lake Nelson (Nelson Lake)	Valley	Nelson County	Fertilized	9	Arrington
Lake Nottoway (Lee Lake, Nottoway Lake)	Piedmont	Nottoway County	Warmwater	9	Wellville
Lake Orange	Northern	Orange County	Warmwater	9	Orange
Lake Pelham	Northern	Culpeper County	Warmwater	9	Culpeper West
Lake Prince	Tidewater	Suffolk City	Warmwater	14	Windsor
Lake Robertson	Valley	Rockbridge County	Warmwater	11	Collierstown
Lake Smith	Tidewater	Virginia Beach City	Warmwater	14	Little Creek
Lake Whitehurst	Tidewater	Norfolk City	Warmwater	14	Little Creek
Lake Wright	Tidewater	Norfolk City	Warmwater	14	Little Creek
Lakeview Reservoir	Piedmont	Chesterfield County	Warmwater	9	Chester
Laurel Bed Lake	Southwest	Russell County	Warmwater	11	Saltville
Lee Hall Reservoir (Newport News Reservoir) (City Reservoir)	Tidewater	Newport News	Warmwater	14	Yorktown
Leesville Reservoir (Leesville Lake)	Blue Ridge	Bedford County	Coolwater	9	Leesville
Little Creek Reservoir	Tidewater	Virginia Beach City	Warmwater	14	Little Creek
Little Creek Reservoir	Piedmont	James City County	Coolwater	9	Norge
Little River Reservoir	Blue Ridge	Montgomery County	Warmwater	11	Radford South
Lone Star Lake F (Crystal Lake)	Tidewater	Suffolk City	Warmwater	14	Chuckatuck
Lone Star Lake G (Crane Lake)	Tidewater	Suffolk City	Warmwater	14	Chuckatuck
Lone Star Lake I (Butler Lake)	Tidewater	Suffolk City	Warmwater	14	Chuckatuck

Lunga Reservoir	Northern	Prince William County	Warmwater	9	Joplin
Lunenburg Beach Lake (Victoria Lake)	Piedmont	Town of Victoria	Warmwater	9	Kenbridge West
Martinsville Reservoir (Beaver Creek Reservoir)	Blue Ridge	Henry County	Warmwater	9	Martinsville East/ Snow Creek
Mill Creek Reservoir	Blue Ridge	Amherst County	Warmwater	9	Piney River
Modest Creek Reservoir	Piedmont	Town of Victoria	Warmwater	9	Rubermont
Motts Run Reservoir	Northern	Spotsylvania County	Coolwater	9	Salem Church
Mount Jackson Reservoir	Valley	Shenandoah County	Warmwater	11	Hamburg
Mountain Run Lake	Northern	Culpeper County	Warmwater	9	Culpeper West
Ni Reservoir	Northern	Spotsylvania County	Warmwater	9	Salem Church/ Spotsylvania/Brokersburg/ Chancellorsville
North Fork Pound Reservoir (North Fork Pound River Lake)	Southwest	Wise County	Warmwater	11	Flat Gap
Northeast Creek Reservoir	Northern	Louisa County	Warmwater	9	Pendleton
Occoquan Reservoir	Northern	Fairfax County	Warmwater	9	Occoquan
Pedlar Lake (Lynchburg Reservoir)	Blue Ridge	Amherst County	Warmwater	11	Buena Vista
Philpott Reservoir (Philpott Lake)	Blue Ridge	Henry County	Coolwater	9	Philpott Lake
Phelps Creek Reservoir (Brookneal Reservoir)	Blue Ridge	Campbell County	Warmwater	9	Brookneal
Powhatan Lakes (Upper and Lower)	Piedmont	Powhatan	Warmwater	9	Trenholm
Ragged Mountain Reservoir (Charlottesville Reservoir)	Valley	Albemarle County	Warmwater	9	Charlottesville West
Rivanna Reservoir (South Fork Rivanna Reservoir)	Valley	Albemarle County	Warmwater	9	Charlottesville East/ Charlottesville West
Roaring Fork	Blue Ridge	Pittsylvania County	Warmwater	9	Chatham
Rural Retreat Lake	Southwest	Wythe County	Warmwater	11	Cedar Springs
Sandy River Reservoir	Piedmont	Prince Edward County	Warmwater	9	Rice
Shenandoah Lake (Lake Shenandoah)	Valley	Rockingham County	Warmwater	11	Harrisonburg
Silver Lake	Valley	Rockingham County	Warmwater	11	Bridgewater
Smith Mountain Lake	Blue Ridge	Bedford County	Coolwater	9	Goodview/Moneta SW/

					Smith Mountain Dam
South Holston Reservoir	Southwest	Washington County	Coolwater	11	Abingdon/Shady Valley/ Holston Valley
Speights Run Lake	Tidewater	Suffolk City	Warmwater	14	Buckhorn
Spring Hollow Reservoir	Blue Ridge	Roanoke County	Coolwater	11	Elliston
Staunton Dam Lake (Staunton Reservoir)	Valley	Augusta County	Warmwater	11	Stokesville
Stonehouse Creek Reservoir	Blue Ridge	Amherst County	Fertilized	9	Piney River
Strasburg Reservoir	Valley	Shenandoah County	Warmwater	11	Strasburg
Stumpy Lake	Tidewater	Virginia Beach	Warmwater	14	Kempsville
Sugar Hollow Reservoir (Charlottesville Reservoir)	Valley	Albemarle County	Coolwater	11	Browns Cove
Swift Creek Lake	Piedmont	Chesterfield County	Warmwater	9	Chesterfield
Swift Creek Reservoir	Piedmont	Chesterfield County	Warmwater	9	Hallsboro
Switzer Lake	Valley	Rockingham County	Coldwater	11	Brandywine
Talbott Reservoir	Blue Ridge	Patrick County	Warmwater	11	Meadows of Dan
Thrashers Creek Reservoir	Blue Ridge	Amherst County	Warmwater	9	Forks of Buffalo
Totier Creek Reservoir	Valley	Albemarle County	Warmwater	9	Esmont
Townes Reservoir	Blue Ridge	Patrick County	Coolwater	11	Meadows of Dan
Troublesome Creek Reservoir	Piedmont	Buckingham County	Warmwater	9	Buckingham
Waller Mill Reservoir	Tidewater	York County	Coolwater	9	Williamsburg
Western Branch Reservoir	Tidewater	Suffolk City	Coolwater	14	Chuckatuck
Wise Reservoir	Southwest	Wise County	Coolwater	11	Wise